

**ABSTRACT**

Devices with electrokinetic elements are disclosed as well as their method of microfabrication for use in micro-scale analysis, mixture separation and reaction. The devices consist of solid hydrophilic-matrix films that have been microfabricated into a variety of micro-scale structures. These structures include hydrophilic-matrix conductors for electrokinetic species transport and separation. They also include hydrophilic-matrix cladding containing chemical species adjacent to either an open conduit or a hydrophilic matrix conductor. Also described are other integrated microstructures consisting of hydrophilic-matrix materials such as micro-reaction zones for retaining chemical species for on-chip chemical reactions and integrated detection structures for on-chip species detection. In general, a hydrophilic matrix on a substrate functions as a conductor that is covered by an electrically insulating, preferably water permeable material.